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BULLETIN OF THE GEORGIA ACADEMY OF SCIENCE

Volume XI April, 1953 Number 1

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PROGRAM NUMBER

THIRTIETH ANNUAL MEETING

OF

THE GEORGIA ACADEMY OF SCIENCE

MERCER UNIVERSITY

MACON, GEORGIA

April 24, 25, 1953

Local Arrangements Chairman—Dr. Gail L. Carver, Professor of Biology, Mercer University.

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Georgia Junior Academy of Science Meeting: Oglethorpe University, April 17, 18, 1953.

Annual Science Fair Exhibits: Faith Hall, Oglethorpe University. April 17, 18, 1953.

BRING THIS PROGRAM WITH YOU TO THE MEETINGS.

PROGRAM

FRIDAY, APRIL 24, 1953

Morning

8:30-12:00 Registration, Luncheon and Banquet Reservations, Chemistry Building.

9:00-11:30 Section Meetings, Presentation of Papers.

11:30-12:00 Section Business Meetings.

12:00- 1:30 Barbecue Lunch.

Afternoon

1:30- 2:30 General Meeting of the Academy, Biology Building, Room 104.

2:45- 5:30 Section Meetings, Presentation of Papers.

Evening

7:30 Banquet, Erwin Poter Hall.

8:30 Principal Address: "Georgia's Geology, and the Life of Its Past." Dr. Horace G. Richards, Academy of Natural Sciences of Philadelphia, and the University of Pennsylvania.

SATURDAY, APRIL 25, 1953

Morning

9:00 Symposium on the Teaching of Chemistry in Secondary Schools.

9:00 Symposium on outside opportunities and encouragements for the talented science student.

SECTION I

BIOLOGY SECTION

FRIDAY, APRIL 24, 1953, 9:00 A.M.

Biology Building, Room 2

Chairman, DR. CLYDE E. KEELER

"Experiences in Soil, Timber and Game Conservation"

GAIL L. CARVER, Mercer University

15 Minutes.

Lactic Streptococcus Bacteriophage Discovered in Georgia

FREDERICK W. BENNETT, The University of Georgia

Lactic Streptococcus bacteriophage was discovered in New Zealand 18 years ago to be the cause of failure in cheesemaking by arresting essential acid development in the milk. Its presence in a commercial dairy processing plant in Georgia recently was established definitely for the first time by work in the Dairy Laboratory of the University of Georgia. No other published report of the identification of phage in commercial operations in the Southeastern States is known to the author.

A lactic streptococcus culture which was used to inoculate milk for the manufacture of cottage cheese and a sample of inoculated milk in which acid development had been interrupted were brought to the laboratory from a dairy plant in the state. Bacteria-free whey was obtained from the latter sample by filtering through a bacteriological filter. Phage was demonstrated in the whey by failure of normal acid development in sterile milk inoculated with the normal culture and the whey, by the disappearance within 3 hrs. of over 99.99 per cent of the living bacteria in the inoculated milk as indicated by plate counts and microscopic examination, and by development of phage plaques on agar plates.

The manufacture of cottage cheese from other lots of milk was resumed successfully in the plant after a thorough cleaning and chlorination of the processing room and equipment and the use of another strain of culture.

15 Minutes.

Some Preliminary Observations on the Effect of Zinc on the Anatomy of Tomato

WILLIAM M. CARLTON, Department of Botany, University of Georgia

Four groups of tomato plants were grown for one month in sterile sand cultures wetted by the drip-culture method with a balanced mineral nutrient solution to which zinc was added at the rates of 0.05, 0.005, 0.0005 and 0.00005 p.p.m. Roots, leaf tissue, and various parts of the stems of representative plants were killed and fixed and made into microscope slides for the purpose of determining what anatomical changes were induced by different concentrations of zinc.

In roots extreme reduction and deletion of zinc are accompanied by certain malformations, by a reduction in meristematic activity,

and by a precocious maturation of tissues, particularly of the cortex, the endodermis, and the phloem.

In stems reduced zinc concentration is accompanied by a decrease in the amount of primary xylem and by its early maturation, by a retarding of cambial initiation and activity, and by an increase in the prominence of the phloem, particularly the internal phloem.

Leaves offer a definite response to low-level zinc nutrition, but the response is more external than internal.

12 Minutes. 2 x 2 Slides.

Intergrades of the Two-lined Salamander, *Eurycea bislineata*, in Georgia

VIRGINIA SWITZER, Division Water Pollution, State Department of Public Health, and THELMA HOWELL, Wesleyan College

When Mittleman, in 1949, considered the changes which the two-lined salamander, *Eurycea bislineata*, undergoes in the southern portion of its range, certain Georgia specimen were of unusual interest. The montane form, *E. b. wilderae*, was reported from Rabun and Gilmer counties, typical *cirrigera* from as far north on the coast as Augusta, and intergrades of *cirrigera* x *wilderae* from Habersham, Clarke, and Gwinnett counties.

In furthre studies of the distribution of the races of *E. bislineata* in Georgia, the present investigators have confirmed the existence of *cirrigera* x *wilderae* in Clark county and have extended the range of the intergrades to Dawson, Cobb, DeKalb, and Oconee counties. Typical *cirrigera* have been found in Bibb and Crawford counties, which lie just below the Fall Line. These studies suggest that the area of integration of *cirrigera* x *wilderae* is the entire Central Upland province, which is the northern part of the Piedmont province of the Appalachian region (Bull. No. 42 Geological Survey Georgia: page 57).

10 Minutes. Slides.

The Effect of Glutamic Acid and Related Compounds on the Metabolism of Mycobacterium tuberculosis

W. B. REDMOND, Veterans Administration Hospital, Atlanta, Georgia

During a study on the utilization of amino acids by the tubercle bacillus it was observed that growth failed to occur when glutamic acid or aspartic acid was autoclaved in a mineral salt solution containing Na and K phosphates, MgCl, $CaCl_2$ and $FeCl_3$. Subsequent experiments have shown that the altered amino acid inhibited growth of the organisms in the presence of all required nutrients. The product of the autoclaved amino acids may be pyrrolidone carboxylic acid in the case of glutamic acid or a piperazine compound of either glutamic or aspartic acid. Tests have shown that DL-pyrrolidone carboxylic acid does not support growth of the tubercle bacillus. Further studies are under way to determine if this compound is inhibitory, and also to determine if the L-form acts in the same way.

15 Minutes. 3¼ x 4 slides.

"Differential Choice of Diet Associated with Plumage Color in the Ring Neck Dove, Streptopelia roseogrisea"

CLYDE KEELER, Georgia State College for Women

In 1940 I observed that if a balanced diet in pellet form was fed by means of a dispenser to several coat color mutant strains of Norway rats derived from a single wild gray strain, the various strains consistently chose a different quantity of food. This is in line with the finding of H. H. Donaldson that rats of mutant strains differ from the wild, gray strain in size of various glands, including thyroid, and therefore might be expected to have different metabolic requirements.

In 1944 the matter was tested further by allowing rats of derivative mutant coat color strains to eat white, wheat bread (unenriched), lard, and a series of vitamin pills, each vitamin being offered in a separate pill. The two mutant strains studied balanced their diets differently as compared with the wild, gray strain from which they were derived.

For seven years I have maintained a few pigmented specimens of the Northeast African dove, *Streptopelia roseogrisea*, as well as a few albino mutants of this species. The two forms differ markedly in their ability to fly. The grays take off like wild birds, whereas, the albinos flutter, having little energy.

During the time that I have observed these birds the albinos tended to choose a diet differing from that chosen by the gray doves, when fed scratch feed consisting of corn, wheat, kafir and oats.

Since I constantly kept in their food dishes more food than they would eat, thus allowing them to choose their diets, the food dishes always contained some rejected materials after the doves had a chance to work it over. Because the rejected materials appeared so different, it was decided to compare the food rejected by a pair of albinos with that rejected by a pair of grays. The albino pair ate wheat, hulled and ate the oats, but rejected cracked corn. The gray pair ate the corn, but rejected the wheat and oats.

A number of possible explanations may be imagined. Physical differences in ability of the gizzard to grind the grain, metabolic differences demanding a different diet, reduction of pigment in the albino eye so that colors appear different (assuming that color vision controls choice), roughness and size differences (if these factors control choice), may all be envisaged. No immediate cause of this correlation can be stated with certainty.
10 Minutes.

SATURDAY, APRIL 25, 9:00 A.M.

Symposium on outside opportunities and encouragement for the talented science student

Participants:

Mrs. Lucile Burnett, Chamblee High School, Chamblee, Ga.
Dr. Arthur Cohen, Oglethorpe
Dr. A. S. Furcron, Ga. State Dept. Mines
Miss Katehrine Hertzka, Hoke Smith High School, Atlanta
Mr. Marvin Jones, Lanier High School, Macon
Mr. Eugene Sanders, Director, Ga. Junior Academy
Others to be announced.

SECTION II

CHEMISTRY SECTION

FRIDAY, APRIL 24, 1953, 2:45 P.M.

Chemistry Building

Chairman, DR. LOYD FRASHIER

The Free-Electron Model of Conjugated and Aromatic Molecules

W. C. CHENG and W. H. EBERHARDT, Georgia Institute of Technology

In recent years many applications have indicated the value to chemists of the very simple model of conjugation electrons moving independently in a box whose geometry is determined by the molecule. These calculations have been based on linear, circular, and spherical models. An extension of this approach to an elliptic cylinder allows very satisfactory representation of the electronic energy states and charge density of such molecules as naphthalene and anthrancene. The solutions to simple problems also provide satisfactory bases for qualitative perturbation arguments for the coupling of aromatic systems such as biphenyl.

20 Minutes.

Lossen Rearrangement of Phthalohydroxamic Acid

CHARLES M. BUESS, Chemistry Department, University of Georgia, Athens, Georgia

In 1894 Lossen reported the synthesis of isophthalo- and terephthalohydroxamic acid. He observed that appropriate derivatives of these compounds underwent rearrangement to polyphenylenureas:

$C_6H_4(CONNaOCOC_6H_5)_2 \rightarrow (C_6H_4NHCONH)x$

Due to the easy cyclization of ortho-disubstituted derivatives, acyl derivatives of phthalohydroxamic acid (I) have not been reported previously.

In the present study conditions suitable for the preparation of the dibenzoyl derivatives of I were found. Its disodium salt was observed to rearrange to a monomeric product (II) rather than to a polyurea. By a study of its chemical reactions and by independent synthesis, II was found to be a benzoyl derivative of 3-hydroxyquinazolinedione. (C_6H_4-CO-NOH-CO-NH).

The action of arylsulfonyl chlorides on sodium phthalohydroxamate has also been investigated.

20 Minutes. **Slides.**

Base Catalyzed, Addition Reactions of Unsaturated Sulfonamides

BILL M. JONES, Chemistry Department, University of Georgia, Athens, Georgia

The well-known addition reactions to conjugated systems as a means of lengthening carbon chains has never been applied to unsaturated sulfonamides. This is probably due to the fact that most of the unsaturated sulfonamides are derived from primary amines or ammonia. The basic catalysts employed in typical addition reactions form salts with such sulfonamides, and apparently this inhibits or prevents attack by another negative ion.

Therefore, ethylenesulfono-(N-ethyl)-anilide which cannot form such salts was prepared and studied. Addition reactions with nitroalkanes, ethyl acetoacetate, ethyl malonate and ketones were found to proceed smoothly.

20 Minutes. Slides.

BUSINESS MEETING

30 Minutes

The Effect of Beta-Halogens on the S_N2 Reactivity of Ethyl Halides

W. H. BRADER, JR. and JACK HINE, Georgia Institute of Technology

A survey of the literature showed the data on the reactivity of aliphatic dihalides toward nucleophilic reagents to be quite meager. Work by Slator (Journal of the Chemical Society, 85, 1290 (1904)) on the ethylene di-halides showed that the effect of beta-halogens on ethyl iodide was to increase the reactivity toward sodium thiosulfate while that of beta- halogens on ethyl bromide was to decrease the reactivity. Experiments in this laboratory have shown that the reactions involving the iodo compounds are not substitution but elimination reactions. Work by other authors was even more ambiguous.

Experiments indicated that under the reaction conditions the beta- halo-ethyl bromides underwent substitution reactions as desired with sodium thiophenolate in methanol. Kinetics on these reactions were followed by titrating the remaining sodium thiophenolate with standard iodine.

The results indicate that the substitution of a halogen for a hydrogen in ethyl bromide decreases the reactivity. It is surprising, however, that the reactivity of the various beta-haloethyl bromides are about the same. One should note that the similarity in reactivity is fortuitous since the energies and entropies of activation vary with each compound.

20 Minutes.

Paper Chromatography Applied to the Quantitative Separation of Copper, Lead and Zinc

JULIA P. GOODE and W. J. FRIERSON, Agnes Scott College

The method of paper chromatography has been applied to the quantitative separation of a mixture of the ions of copper, lead, and zinc. The major problems involved were to determine suitable conditions for maximum separation, to remove quantitatively the ions from the paper strip, and to estimate the quantities of the ions by colorimetric methods.

The sample, containing 5 or 10 micrograms of the ions, was applied to one end of the filter paper strip with 5 λ micro-pipet. The spot was dried; the strip was hung in a solvent-containing dish and allowed to develop for 12-16 hours. The solvent used was a mixture of n-butyl alcohol, acetone, water and sulfuric acid.

The positions of lead and copper were located by the formation of the sulfides and that of zinc by spotting the strip with a solution of dithizone in carbon tetrachloride.

After separation, the strips were cut apart and the ions eluted by treatment with warm, dilute acid. The ions were then extracted from the acid with a carbon tetrachloride or chloroform solution of dithizone and quantitatively estimated with a Klett-Summerson photo-electric colorimeter.

Good results were obtained using microgram quantities.

20 Minutes.

The Preparation of *B*-Ketodimethylacetals and Methoxymethylene Ketones from Hydroxymethylene Ketones

KENT C. BRANNOCK and E. EARL ROYALS, Department of Chemistry, Emory University

Sodium hydroxymethylene ketones are readily prepared by the Claisen condensation of methyl formate and ketones with sodium methoxide.

$$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_3 + HCO_2CH_3 + NaOCH_3 \rightarrow R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH{=}CHONa + 2\ CH_3OH$$

Those of the type R-CO-CH=CHONa give good yields of *B*-ketodimethylacetals on treatment with methanolic hydrogen chloride.

$$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH{=}CH\text{-}ONa + 2\ CH_3OH + HCl \rightarrow R\text{-}\overset{O}{\overset{\|}{C}}\text{-}\overset{H}{C}H_2\text{-}C(OCH_3)_2 + H_2O + NaCl$$

The sodium salts of hydroxymethylene acetophenone and hydroxymethylene-cyclohexanone give the corresponding methoxymethylene ketones on similar treatment.

$$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH{=}CH\text{-}ONa + CH_3OH + HCl \rightarrow R\text{-}\overset{O}{\overset{\|}{C}}\text{-}\overset{H}{C}H{=}C\text{-}OCH_3 + H_2O + NaCl$$

Sodium salts of the type R-CO-CR′=CH-ONa give mixtures of *B*-ketodimethylacetals and methoxymethylene ketones. Evidence is presented that the Claisen condensation of methyl formate with methyl ethyl ketone and methyl *n*-propyl ketone occurs at both the methyl and methylene units of the ketones. *B*-Ketodimethylacetals and methoxymethylene

ketones are readily cleaved by aqueous alkali to give methanol, formic acid, and the ketone from which they were derived.

$$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_2\text{-}C(OCH_3)_2 + NaOH + H_2O \rightarrow R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_3 + 2\ CH_3OH + HCO_2Na$$

$$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH{=}C\text{-}OCH_3 + NaOH + H_2O \rightarrow R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_3 + CH_3OH + HCO_2Na$$

20 Minutes

CHEMISTRY SECTION

Saturday, April 25, 9:00 A.M.

Symposium on the Teaching of Chemistry in Secondary Schools. What Can be Done to Improve Teaching in Our Schools?

By Lecture Demonstrations
(Speaker to be announced)

By Projects
COLONEL J. EDGAR MORRIS, Brown High School, Atlanta

By Working with Special Students
W. H. EBERHARDT, Georgia Institute of Technology

By Industry
F. HOMER BELL, Philadelphia Quartz Co., Atlanta

SECTION III

EARTH SCIENCE SECTION

FRIDAY, APRIL 24, 9:00 A. M.

Physics Building, Room 3

Chairman, PROF. ROMEO J. MARTIN

Columnar Mud-Cracks in a Northeast Georgia Cave

R. M. CRISLER and R. E. MURPHY, Emory University, Ga.

In Case Cave, Dade County, Georgia, mud-cracks of an unusual nature are found. These cracks bound polygonal columns approximately nine inches in diameter and twenty-four inches in depth.

The columns will be described, and an attempt will be made to explain the conditions of their deposition and preservation.

Ten Minutes. 2x2 Slides.

Geomagnetics of Savannah Valley

C. E. ROWLANDS, JR and H. W. STRALEY, III, Geophysics, Georgia Institute of Technology

During the 1930s, the University of North Carolina ran reconaissance magnetic surveys into the valley of the Savannah. They discovered what appeared to be a magnetic basin between Charleston,

South Carolina, and Savannah, Georgia. Northward lies a high passing through Summerville, South Carolina, and trending southwest. Southward appeared to be another, trending northwest through Savannah.

The writers have covered the area in some detail and find that modifications must be made in the previous concept. The high on the Georgia side of the valley is not continuous and the depression appears to open southward into Georgia. It is partially closed along the coast, opening seaward about Port Royal Sound.

15 Minutes. 3¼x4 Slides.

Oolites From the St. Genevieve and Gasper Limestones from Northwest Georgia

FRANK T. INGRAM, Emory University, Ga.

An investigation of oolites in the oolitic zones of the St. Genevieve and Gasper limestones indicates that they were deposited in shallow water where wave action played an important role in their formation. The nuclei of many of these oolites are foraminifera and various fossil fragments. Heretofore, no foraminifera have been described from the Mississippian system in Georgia. The mode of origin of the individual oolites is in doubt but the author favors a process by which oolites are now forming in the Great Salt Lake in Utah.

10 Minutes..

The British Moorlands: A Problem in Land Utilization

JOHN FRASER HART, Department of Geography, University of Georgia

Britain must import less and export more to survive in the postwar world. Approximately half of the British imports are food, since the agricultural land of Britain can support less than one-third of the nation's population. It is surprising, therefore, that one-third of the island is moorland, land which to the casual observer appears completely unused.

Agricultural use of the moorlands is restricted by such factors as excessive precipitation, low evaporation, steep slopes, and altitudes which are exposed to high winds and low temperatures. The resulting vegetation of coarse grasses and shrubby bushes is used primarily for sheep pasture to produce lambs for fattening and low grade wool. It is claimed by agriculturalists that the food production of the moorlands could be increased if government subsidies were granted for burning, plowing, fertilizing, and reseeding the lower portions to increase their carrying capacity.

On the other hand, two world wars have revealed that Britain is desperately short of wood, and an ambitious plan to double the forested acreage of the island is in operation. The only land which can be spared for afforestation, however, is the same lower moorlands which the agriculturists wish to improve for food production. The moorlands must therefore be analyzed in terms of their relative potentialities for forest or grazing land in order to provide a rational basis for allocating adequate moorland acreages to both farmer and forester, since both meat and timber production must be increased if possible.

18 Minutes. 2x2 Slides and 3¼x4 Slides.

Some Foundation Problems Associated with Bedrock West of Rome, Georgia

GEORGE F. SOWERS, Associate Professor of Civil Engineering, Georgia Institute of Technology

Rome lies in the Paleozoic region of Northwest Georgia. The underlying rocks are primarily limestones and shales with occasional thin seams of sandstones. The limestones are very hard and dense and in the massive form make excellent foundation for heavy structures. Excavation in them is difficult because of their tendency to shatter.

While no major defects have appeared, numerous minor defects in the rock have complicated foundation construction. First, the rock surface is extremely irregular. Second, solution-enlarged fissures and joints are scattered throughout the rock with no general pattern of occurrence. These necessitate careful exploration, cleaning, and filling with concrete to enable heavy structures to be supported safely.

15 Minutes. Slides.

Petrographic Study of the Porphyroblasts of the Fairburn Granite East Point, Ga.

H. E. COFER and J. G. LESTER, Emory University, Ga.

The porphyroblasts of the Fairburn granite near East Point, Georgia are studied in detail using oriented petrographic sections in order to more clearly define the orientation of inclusions with respect to crystallographic directions.

The porphyroblasts are composed of potash feldspar which contains as inclusion biotite, muscovite, plagioclase, epidote, zircon and quartz.

15 Minutes. 2x2 Slides.

Paleontology in Georgia Schools

MISS LEWIS LIPPS, Asst. Prof. of Biology, Shorter College

The value and high quality of amateur research, done by grade school and layman workers, has been indicated in the extensive research of Western Reserve University, reported in *The Amateur Spirit in Scholarship*, by Dix. Encouragement, and help in the discipline of keeping records, proved the only aid commonly necessary.

The Earth Sciences have admittedly been a neglected sector of science. Georgia, with its wealth of fossil material, is proving a nearly ideal environment for introducing the Earth Sciences, both to children who carry fossils as toys, and to their hitherto untutored, but able teachers.

There is increasing evidence that the ground work for correlation of fossil study to general geology and soil study has already been laid by U. S. Soil Conservation and other agricultural men. The cultural value of knowledge of the early earth history of Georgia would seem unquestionable.

Actual work along these lines has been started in several communities. Reports and slides will be given.

20 Minutes. 2x2 Slides.

Business Meeting

20 Minutes.

On Ferruginous Nodules Occurring in the Soils of Some Areas of the Piedmont and the Coastal Plain

W. H. GRANT, Emory University, Ga.

Nodules from three widely separated areas are described. The nodules are found in the soil mantle and appear as small brown rounded bodies. Except for the included minerals these nodules seem to be independent of the underlying rock. Rocks rich in iron generally produce greater numbers of them. Some of the nodules are magnetic and a very few exhibit weak polarity.

Hypotheses are offered to explain the origin of the nodules and their magnetic properties.

10 Minutes.

Recreation as a Factor in Future Population in the Lake Superior Upland Area

JAMES F. WOODRUFF, Department of Geography, University of Georgia

Agriculture and forestry, the present bases for population, in the Lake Superior Upland area are briefly discussed and it is concluded that significant increases in population based upon these activities are unlikely. The question of future expansion of recreation as a foundation for increasing population is raised, and certain ramifications regarding the effect of such an expansion upon forestry and agriculture are discussed. The area is delimited and divided into two sub-regions: the Albany Drainage region and the Lake Superior region. The recreational attractions, facilities, and possibilities are enumerated and elaborated upon. The present and future transportation media are described. The conclusion is reached that the Albany Drainage region will experience little expansion of recreation because of physical handicaps, while the Lake Superior region will, contingent upon the completion of the littoral highway, see a significant increase in recreational use and a consequent economic improvement in the area.

12 Minutes. 2x2 Slides.

Observations on the Types and Directions of Lineation in a Portion of the Eastern Georgia Piedmont

ELDON J. PARIZEK, Department of Geography & Geology, University of Georgia, Athens, Georgia

Several types of linear elements exist in the crystallines of the eastern Georgia Piedmont, in an area embracing several hundred square miles. The following kinds have been recognized: primary flowage, secondary flowage, slippage, rotation, and intersection of planes. Lineation in *b* is most pronounced in the southeast portion of the area, while lineation in *a* is best developed in the northwest.

Linear directions shift from approximately N20°-30°E in the southeast, to N45°-50°W in the northwest. Pitch of the lineation is consistently south, independent of the strike and dip of bedding or foliation. In some localities lineation is more strongly developed than in others. Though genesis of the various lineations is not of primary consideration in this paper, the origin of some types is indicated as fairly certain and the co-genesis of some is suggested.

15 Minutes. 2x2 Slides.

Electric Logging of Water Wells

JAMES R. WELLS, Civil Engineering, Georgia Institute of Technology

In February 1932 Conrad and Marcel Schlumberger and E. G. Leonardon presented a discussion of studies made "in situ" of the formation traversed by a drill hole before it is cased. This marked the beginning of electric logging. The first studies were made by measurements of resistivity. As the science grew, other parameters were used to differentiate formations. Among the more important are spontaneous potential or S. P., fluid temperature, hole diameter, fluid resistivity, and rate and direction of fluid movement.

The use of these parameters to obtain subsurface information has grown phenomenally. At first, the investigations were restricted to "pure" science. Today there are numerous uses of the electric log including location of petroleum, coal, and other minerals, and in foundation exploration. Their widespread use is indicated by the fact that today 90% of all oil wells drilled are logged.

About 1935 the Illinois Geological Survey began extensive use of electric logging for the location of water-bearing strata. Use of logs has expanded and now many water wells are logged in all sections of the country. The United States Geological Survey co-operates with private parties in logging Georgia water wells.

Uses in water-well drilling include the following: study of lithology; measurements of casing depth and diameter; location, thickness, and importance of the water-bearing strata; salinity of water at different depths; temperature of water in different strata; location of caving zones and "fish"; and a record of fluid movement. Methods of obtaining logs vary almost as much as uses. Equipment may be capable of obtaining all parameters and cost thousands of dollars, or used for one specific purpose and cost a few dollars. Although the former is desired for complete understanding of ground conditions, the latter can be used effectively to solve simple problems encountered in water-well drilling.

20 Minutes. Illustrative materials; Charts and blackboard.

Animal Tracks in Ordovician Chert of Northwest Georgia

A. T. ALLEN and J. G. LESTER, Emory University

On a chert bed of Upper Ordovician Age which is exposed in Rabbit Valley, Catoosa County, there occur trails and tracks of some crawling animal or animals.

Speculations as to bulk of animal, condition of sea floor and form of animal are made.

15 Minutes. 3¼x4 & 2x2 Slides.

The Climatographic Map

EUGENE MATHER, Department of Geography, University of Georgia

Earth scientists often need a device for integrating climatic data in their areal situation so that salient features of precipitation, temperature, and wind can be comprehended readily. Three problems frequently arise: 1) several types of data must be integrated in brief form, 2) the areal occurrence of this data must be depicted, and 3) the nature and quantity of the data may vary to such a degree that conventional methods of presentation may not be suitable. All three of these problems are confronted simultaneously in most areas of sparse settlement with few weather stations. The climatic data presented on the Climatograph Map were obtained in a region of over 20,000 square miles where density of recording stations was so scant that the preparation of isarithmic climatic maps certainly would not be feasible. Moreover, the mere presentation of the data in a series of tables or conventional graphs would be both cumbersome and out of areal context. Data presented by the Climatograph include average date of last killing frost in spring, average date of first killing frost in fall, average precipitation for each month of the year, average temperature for each month of the year and prevailing wind direction for January and for July. All of this data is shown graphically on a map at the place of its recording to indicate its areal disposition. The development of the Climatograph was suggested by the Richard Hartshorne thermograph. The Climatograph is designed so that it may be used under a variety of conditions when conventional methods are inadequate.

10 Minutes. 2x2 Slides.

Sedimentary Study of a Commercial Sand Deposit in Northwest Greene County, Georgia

ELDON J. PARIZEK, University of Georgia, Athens, Georgia

Unconsolidated arkosic sediments, situated near the confluence of Rose Creek and the Oconee River, in northwest Greene County, Georgia, are described. Well developed cross-bedding, apparent rechanneling, and absence of marine fossils strongly suggests that the sediments are of an original flood-plain origin. The deposits cover an area of approximately 30 acres, with a thickness in places greater than 60 feet. The sands are currently being worked for commercial purposes.

Laboratory anlayses of 28 samples from the area are graphically shown, in addition to other pertinent sedimentary data. Several interpretations with regard to the deposits are presented.

12 Minutes. 2x2 Slides.

SECTION IV

PHYSICS, MATHEMATICS & ENGINEERING SECTION

FRIDAY, APRIL 24, 9:00 A.M.

Physics Building, Room 5

Chairman, DR. W. A. CALDER

Sputtering – A Significant Method of Metal Deposition*

MARGARET CHESTER and RICHARD B. BELSER,
Georgia Institute of Technology

Sputtering is a process of metal deposition occurring when a metal cathode is bombarded by positive ions in a vacuum chamber maintained at a pressure of approximately 10^{-1} - 10^{-2} mm of mercury. This phenomenon was first described by W. R. Grove in 1852.

Although many studies of sputtered metal films have been made before the advent of the electron microscope and the electron diffraction camera, relatively few have been made since, one reason being the development of the vacuum evaporation technique. Sputtering, however, remains an interesting, valuable and relatively simple metal coating method. Films of silver, gold, platinum and other metals have a number of uses in optical and electrical manufacturing industries; and a use of some present importance is sputtered electrodes for quartz piezoelectric crystals.

In order to explore this latter use an extensive study of sputtered films has been made. Interesting and valuable data concerning the structures, resistivities and stabilities of these films have been obtained. Resistivity value for films of gold, silver, platinum and palladium have been found to be in the range 1.5-2.0 bulk resistivity after artificial aging by heating. These resistivities are lower than any prevously reported for sputtered metal films.

Time 10 Minutes. 3¼x4 Slides.

The Aging Characteristics of Thin Metal Films*

RICHARD B. BELSER, Georgia Institute of Technology

Extensive studies of the structures, resistivities and aging characteristics of films of the metals gold, silver, copper, aluminum, nickel, platinum and palladium have been made. The deposition methods employed were evaporation, sputtering and electroplating.

Regardless of the method of deposition, electron diffraction studies have shown the films to be composed generally of small crystallites. Because the films are deposited atom by atom, or little by little, on a foreign surface and intermingled with foreign atoms during their growth, they are subjected to a certain amount of strain and disorder not so predominant in a metal cooling in bulk from a molten condition.

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*Supported by the U. S. Army Signal Corps.

With time alone, or with heating, the atoms of the film usually undergo a change to a state of greater order. This change is accompanied by changes in optical properties, electrical resistance and x-ray and electron diffraction patterns. By proper adjustment of time and temperature relationships, optimum lattice conditions of a film may be obtained. This state is signified by a minimum electrical resistivity. For evaporated or sputtered films, of approximately one thousand angstroms thickness, resistivities of 1.3 to 1.5 bulk resistivity appear normal.

Effects of corrosion and aggregation are also discussed.

20 Minutes. 3¼x4 Slides.

The Effects on the Scintillation Efficiency of Terphenyl-Dioxane Solutions of the Additions of Some Salts

WALTER W. BRANDON and R. H. ROHRER, Emory University

The use of terphenyl-dioxane solutions as liquid scintillators has been described.[1,2,3,4] Preliminary investigations of the possible use of this water-soluble solution as a high-efficiency detector for the radiation from potassium 40 required that the "poisoning" of the scintillating properties of this solution be studied. A report of the effects of the addition of KCl to the liquid scintillator on pulse height, counting efficiency and optical transmission will be made, and the apparatus in use will be described.

15 Minutes. 3¼ x 4 Slides.

1. Farmer, E. C., and Bernstein, I. A., *Science 115*, 460 (1952).
2. Kallman, H., *Phys. Rev. 78*, 488 (1950).
3. Raben, M. S., and Bloembergen, N., *Science 114*, 363 (1951).
4. Rollefson, G. K., and Boaz, H., *J. Phys. Chem. 52*, 518 (1948).

A Triple-Coincidence Method for the Identification of Positron Activity in Potassium 40

R. H. ROHRER and WALTER W. BRANDON, Emory University

The mass difference between the naturally occurring radioactive isotope K^{40} and its decay product, $argon^{40}$ is sufficient to allow positron decay to exist. Several workers[1,2,3,4] have made efforts to determine the presence of such radiation from this isotope, and have failed to agree on the amount present. A triple-coincidence scintillation detector system has been suggested[5] as a means of identifying quantitatively the amount of positron emission. A description of the operation of such a system and some preliminary considerations will be reported.

15 Minutes. 3¼ x 4 Slides.

1. Fireman, E. L., *Phys. Rev. 75*, 1447 (1949).
2. Colgate, S. A., *Phys. Rev 81*, 1063 (1951).
3. Good, M. L., *Phys. Rev. 81*, 1058 (1951).
4. Bell, P. R., and Cassiday, J. M., *Phys. Rev. 79*, 173 (1950).
5. Good, M. L., Private Communication.

An Approach to Solving Equations in X

JAMES H. WAHAB and RALPH A. WILLOUGHBY, Georgia Institute of Technology

The basic idea is that each equation in X partitions a given set of numbers into sub-sets, one of which consists of the numbers "satisfying" the equation. A logical analysis based on this partitioning facilitates the understanding of solving equations, introduces set-theoretical concepts in a natural way, and lays a foundation for more advanced mathematical reasoning.

20 Minutes.

The Undergraduate Physics Program at Emory University

D. R. McMILLAN, Emory University

The college program leading to a Bachelor of Arts degree with specialization in physics will be discussed. A modified form of this program has been in operation during the current academic year, and conversion to the complete program will be accomplished by the Fall of 1953. The new course of instruction is designed to accomplish a two-fold purpose: (1) to fit within the framework of the requirements for the liberal arts degree, and (2) to offer adequate preparation to those students who wish to follow physics as a career, either as a teacher, or professional scientist.

Provision has also been made for an accelerated program in physics and mathematics so that the exceptional student will be able to secure much more training in physics than would otherwise be possible.

20 Minutes. 3¼ x 4 Slides.

Visual Demonstration of Doppler Effect

WILLIAM A. CALDER, Agnes Scott College

Doppler effect is usually illustrated by change of pitch caused by motion of a sound source. From this, it is inferred that the wave length is changed when the source is in motion. An arrangement by which the actual change of wave length is strikingly shown has been devised. The ripple pattern produced by a tuned, moving source is observed stroboscopically by the light of a neon glow lamp.

5 Minutes. 2 x 2 Slide.

A Compact and Inexpensive Solar Observatory

WILLIAM A. CALDER, Agnes Scott College

The sun is constantly putting on a show which few are privileged to observe. A complete solar observatory has been built which fits onto a small table which can be carried out and put into action in five minutes. A coelostat run by Telechron motor feeds light into a horizontal 2.5" telescope which is used to view sunspots in integrated light, and which gives excellent views of prominences in the 6563 Angstrom line of hydrogen.

5 Minutes. 2 x 2 Slides.

Variable-Impedance Elements in Circuits

JOSEPH FINE (Introduced by D. R. McMILLAN), Emory University

Circuits in which some impedance elements are variable frequently display interesting properties. Examples of such circuits are described.

20 Minutes. 3¼ x 4 Slides.

Precision Frequency Measurements

JAMES W. SIMMONS, Emory University

Some of the problems involved in the measurement of frequencies of absorption lines in microwave spectroscopy to an accuracy of the order of 1 part in 10^6 will be considered and the secondary frequency standard which has been developed for this purpose at Emory University will be described.

20 Minutes. 3¼ x 4 Slides.

Some Applications of Motor Algebra in Mechanics

A. G. PEARSON, Emory University

Vector analysis may be extended by the use of the dual numbers of W. K. Clifford. Such numbers are of the form $x + \varepsilon y$, where $\varepsilon^2 = 0$. This leads to the study of "motors," which have applications in mechanics. Examples of such applications will be presented.

20 Minutes. 3¼ x 4 Slides.

SECTION V

PSYCHOLOGY-MEDICINE SECTION

FRIDAY, APRIL 24, 1953, 9:00 A.M.

Biology Building, Room 4

Chairman, MRS. EMILY BARRY WALKER.

Symposium on Cerebral Palsy

Introduction and Survey of Cerebral Palsy Research—Emily Barry Walker.

Present Concepts in the Training of the Cerebral Palsied—Martha Schnebly.

Psychological Problems of Cerebral Palsy—Florence M. Young.

Speech Development in the Cerebral Palsied Child—Mary Rose Costello.

Problems of a Dentist with the Cerebral Palsied Child—Chester Lloyd

Drugs Used in Treatment of Cerebral Palsy—James L. Morrison

Neonatal Asphyxia and Brain Injury—Faith S. Miller.

2 x 2 Slides and 16 mm. Motion Picture.

Introduction and Survey of Research in Cerebral Palsy

MRS. EMILY BARRY WALKER, Assistant Professor of Anatomy, Emory University School of Dentistry

The past two decades, and even the past five years, have witnessed an amazing increase in the study and treatment of the cerebral palsy child. In th recent past much has been learned about cerebral palsy that is of great value.

The UCP Research Council lists the research as follows:

1. The cause or causes.
2. Better methods or techniques of treatment.
3. Probable, possible or even partial preventives.
4. Palliatives, remedial procedures and perhaps some day a cure.

The present paper deals with anatomical, both gross and microscopic, evidence that might aid in solving some of the above problems.

The work involved the study anatomically of two cerebral palsy cadavers in the Gross Anatomy Laboratory, Emory University Dental School. By means of sections of the brain and spinal cords a study was made of the distribution of fibers.

Present Concepts in the Training of Cerebral Palsied

MARTHA E. SCHNEBLY, Acting Coordinator, Cerebral Palsy School-Clinic of Atlanta, Inc.

Training of the Cerebral Palsied in this talk is limited to that carried out in Physical and Occupational Therapy. Usually the purposes for these therapies are: 1. to attempt to develop better neuro-muscular coordination, 2. to find the most efficient and practical method for independence in daily living, and 3. to develop capabilities for adulthood.

Training for better coordination has been based on clinical practices from three main schools of thought—Dr. Winthrop Phelp's theories of conscious relaxation, Dr. Temple Fay's developmental patterns and Dr. Herman Kabat's mass movements and resistance.

Efficient methods of daily care usually must work around the incoordination and use those motions which the child can partially control. Carry over from one activity to another is believed to be minimum so each must be learned individually.

Adulthood of the Cerebral Palsied has been given minor attention in the past so emphasis is just beginning in that direction for development of pre-vocational activities as a part of treatment.

Psychological Problems of Cerebral Palsy

DR. FLORENCE M. YOUNG, Department of Psychology, The University of Georgia, Athens, Georgia

The present study reports the results of administering individual psychological tests to 80 children diagnosed by medical examiners as cases of cerebral palsy. In addition, retest results of 24 of the cases will be discussed.

The findings indicate retardation for the group as a whole, but

normal or even high ratings for some subjects. Need for caution in interpretation of test results is emphasized. Special psychological problems arising with cerebral palsy cases appear to affect test scores in some instances.

Speech Development in the Cerebral Palsied Child

MARY ROSE COSTELLO, Director Junior League Speech School, Atlanta

This paper will discuss the multiplicity of handicaps motor, sensory, psychological and mental which affect the development of speech in the cerebral palsied child. The need for a coordinated approach to achieve acceptable speech will be pointed out, with emphasis on the dependence of speech development upon physical and psychololgical behavior.

The particular speech problems of the cerebral palsied child will be discussed as well as general methods of treatment.

Problems of a Dentist with the Cerebral Palsy Child

DR. CHESTER LLOYD, Head of Dental Clinic, University of Tennessee Dental School, Memphis

This paper is an account of the work done by the Cerebral Palsy Dental Clinic which has been established and the work carried on in connection with the Dental School in Memphis. This work seems to be unique as to its plan and instigation.

Drugs Used in the Treatment of Cerebral Palsy

JAMES L. MORRISON, Emory University

Many drugs have been used in the attempt to treat cerebral palsy patients. Few if any have been found useful. Sedatives have in some instances proved helpful and of these perhaps Methenesin has been found to be most effective.

Neonatal Asphyxia and Brain Injury

DR. FAITH S. MILLER, Research Assistant, Department of Anatomy, Emory University

Depression of the infant's respiratory center, especially by oversedation of the mother, often results in asphyxiation of the infant. Clinical reports and animal experimentation present evidence of damage to the brain resulting in motor defects and decreased learning ability. In our experiments use of low temperature, ATP and hydrogen peroxide gave protection from asphyxia.

11:30-12:00 Business Meeting
Election of Officers

2:45- 5:30 P.M. Research Papers

Differential Decline in Graduate Student Performance With Age

R. TRAVIS OSBORNE and WILMA B. SANDERS, University of Georgia, Athens, Georgia

Problem and Population:

This study was designed to test the hypothesis that there are no significant age differences in graduate students' performance on the profile tests of the Graduate Record Examination. The population studied was the Graduate Student Body of the University of Georgia in attendance between February, 1946, and February, 1952, (N=1714).

Results:

Significant age differences in achievement were found in the areas of Mathematics, Physics, Chemistry, and Biology with the younger students demonstrating the superior knowledge in these fields. Scores in Social Science, Literature and Fine Arts tend to hold up with age and in some cases the older graduate students showed better retention of content in these fields than their younger classmates, thus reversing the trend toward performance decline with age found for the sciences.

12 Minutes. 3¼ x 4 Slides.

Preliminary Observations on the Formation of Secondary Conditioned Motor Responses in Dogs

W. T. JAMES, University of Georgia

Pavlov states in the discussion of Conditioned Reflexes that Secondary Conditioned responses may be formed by applying a neutral stimulus along with one which has already been used to form a conditioned response. Only one mention is made of this form of behavior in his large volume on Conditioned Reflexes, and this is not very convincing. The American Psychologists have neglected this problem. They have been much concerned with what is called secondary reinforcing stimuli, but not with the formation of Secondary Reflexes in the Pavlovian sense.

The present paper reports an experiment on the formation of a secondary conditioned response of the foreleg of a dog to a flashing light signal, using as a reinforcing stimulus a buzzer which did elicit a positive response of the leg. A secondary conditioned response did not develop after a relatively large number of signals, but there were definite automatic changes to the signal.

The present results may imply that secondary conditioned responses of the sympathetic system may form without the accompaniment of the motor systems. If this is so, it would seem to be of importance and warrent further investigation.

20 Minutes. 3¼ x 4 Slides.

Tactual Kinaesthetic Depth Perception and Illusion

AUSTIN S. EDWARDS and EARNEST C. LAND, University of Georgia

Report will be made of results of experimental work in a new field of depth perception, namely, tactual-motor. Experiments have been performed upon depth or distance forward-back, and right-left. Some comparisons are possible with studies of visual depth perception. It appears possible that a new illusion (tactual-motor), not before published in the literature has been discovered and will be reported. All experiments have been performed with vision and learning eliminated.

12 Minutes.

Section VI

PHILOSOPHY AND HISTORY OF SCIENCE SECTION

Biology Building, Room 5

FRIDAY, APRIL 24, 1953, 9:00 A.M.

Chairman, DR. GEORGE C. SEWARD

The Analysis of the Meaning of Science, Scientific Method, and the Extent to Which Some Important Disciplines in Our College Curriculum Can Be Called Sciences

By UNO KASK, Armstrong Junior College, Savannah, Georgia

Outline of the Paper:

1. Preliminary definition of "science."
2. The elements of the scientific cognition: known, knower, knowing, and knowledge.
3. The scientific method: observation, induction, deduction.
4. Relating symbols and events in the process of scientific inquiry.
5. Discussion of the various stages involved in the scientific method as proposed by some of our leading philosophers of science.
6. Explanatory, descriptive, and autonomous sciences.
7. The analysis of the extent to which some of our major college studies are sciences or nonsciences.

30 Minutes.

Truth Criteria in the Social Science of Giambattista Vico

ROLLIN CHAMBLISS, Professor of Sociology, University of Georgia

The new science of Giambattista Vico must be seen against the background of Cartesian rationalism. Like Descartes, Vico believed that reason is the measure of truth, but he insisted that reason needs to be fortified in the natural sciences by experimentation and in the social sciences by comparative analysis. Where

reason is not restrained by experience, ignorance and bigotry rather than truth are likely to be the outcome. Vico did not deny the Cartesian criterion of truth—i.e., clear and distinct ideas; but he insisted that only that is clear and distinct which we have ourselves created. If, as Vico, believed, the criterion of truth is to have made it, the value of the study of history and literature, which the Cartesians had questioned, becomes obvious. Word symbols, legends, and myths explain the behavior of men and embrace their collective wisdom. This kind of knowledge is not uncertain, as Descartes had claimed. On the contrary, it is the most certain knowledge of which man is capable. In language, myths, fables, legends, laws, and customs the mind of universal man is revealed, and social phenomena can be known as the awful forces of nature can never be.

Thus did Vico voice his opposition to the materialism of his age and declare himself to be a humanist. He found productive science in an area which Descartes had assumed to be barren. He showed that the scientific method, widely acclaimed in his day but limited in its application, could be adapted to humanistic studies, and that the impulses and yearnings and "blank misgivings of a creature moving about in worlds not realized" are not less, but more, understandable than are the laws of nature.

30 Minutes.

Economic and Statistical Interpretation of Time Series Analysis

GREGOR SEBBA (Introduced by DR. SEWARD), University of Georgia

The customary technique of decomposing economic time series consists in isolating four basic types of variation: long term trend, irregular cyclical fluctuations, seasonal and random variation. This technique is based on a formal classification of types of movements under normal probability assumptions. It is difficult to assign economic meaning to the resulting components and to arrive at a theoretical basis for forecasting.

New approaches have so far been made mainly from two directions. (1) Econometric theory has begun to develop mathematical models that show cyclical fluctuation and can be modified to include growth. These models are not yet concretely predictive; the question of their correspondence with reality is still open. (2) Work in communication theory ("stationary" time series) is beginning to be applied to economic time series, but this is still in its beginnings. The approach is strictly statistical, and again the link between economic and statistical analysis is as yet tenuous.

The problem of economic time series analysis throws light on the difficulties of making economics a concretely predictive science. The need for casual, formal, and predictive analysis has led to the development of tools independent of economic theory. On the other hand, new tools are being autonomously developed both by economic and by statistical theory. Fundamental methodological analysis of the problem is lagging.

30 Minutes.

Some Observations on the Limnology of Georgia Lakes

ROBERT S. INGOLS, Georgia Institute of Technology

The principals of the science of Limnology have been largely developed in the large biology departments of our Northern Universities. The application of these concepts to the lakes near Atlanta is obviously possible, but there are many local factors that influence the condition of these lakes. The high turbidity of the lake waters surprises many newcomers. The turbidity and the steep slope of the lake bottom influences the temperature of the lake water. The rapid rate of weathering of igneous rock contributes to the development of an abundant flora. The mineral content of manganese in the local lakes contributes severe problems in water treatment in many towns. Pollution of the rivers and lakes in Georgia provide other interesting problems.
30 Minutes.

Forum Discussion: With what problems should Section VI concern itself?

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